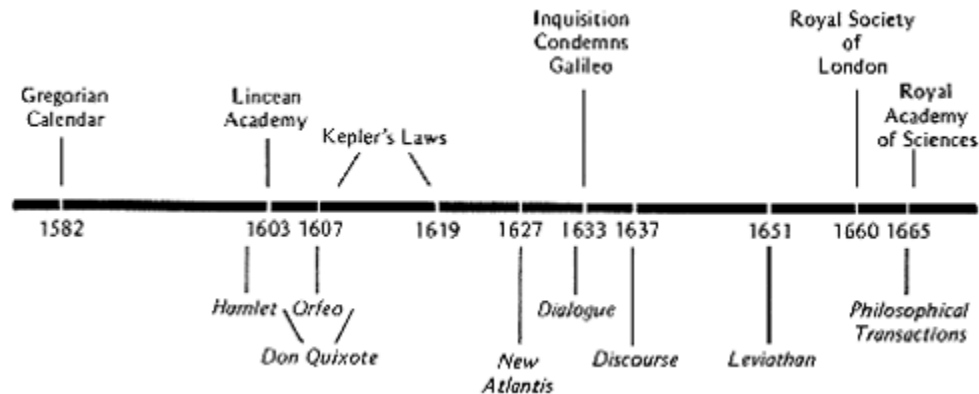


## **REVIEW GUIDE FOR THE SCIENTIFIC REVOLUTION**

### **TIME LINE**



While the attention of Europe had been focused on politics and war great changes were occurring in the realm of ideas. By the early seventeenth century, exciting new developments were under way in astronomy and the physical sciences. It was during this time that scientists laid the foundations for the scientific study of anatomy and physiology, chemistry, biology, physics and geology. The methodology of science was debated, and scientific societies were established to promote further research and the spread of the new knowledge. The Scientific Revolution ultimately brought radical changes to people's understanding of the entire physical universe. A cosmology is a systematic conception of the universe. It is a world view that satisfactorily explains the operation of the universe. From the fourth century B.C. to the sixteenth and seventeenth centuries, the Aristotelian Ptolemaic cosmology prevailed. Accordingly, the cosmos was made up of four elements earth, fire, water, and air. It was geocentric. The earth, at the center, was enclosed in a series of crystalline spheres in which were embedded stars and planets revolving on cycles and epicycles in circular yet complex patterns. Beyond the spheres lay the empyrean blue where God resided. Motion resulted from angels' hands revolving the crystal orbs. The entire conception accorded with church teachings and Scriptures.

### **THE SCIENTIFIC REVOLUTION**

A revolution took place, in the stretch of time between publication of works by Nicolaus Copernicus (1473-1543) and Isaac Newton (1642-1727), that shattered the old heavens and substituted the Newtonian cosmology, mathematical and mechanistic in its conception of the universe. Copernicus proposed a heliocentric system that simplified the complex pattern of cycles and epicycles by reducing their number. Tycho Brahe (1546-1601), the Danish astronomer, catalogued the stars. In Germany, Johannes Kepler (1571-1630) formulated planetary laws and theorized that the planets moved in elliptical rather than circular patterns. Galileo (1564-1642) formulated terrestrial laws and the modern law of inertia. He used the telescope to discover the four moons of Jupiter and prove that Jupiter was not encased on any crystal orb, and thus he provided evidence for the Copernican theory. These findings brought trouble with church authorities, who placed Galileo under house arrest.

### **NEWTON'S SYNTHESIS**

The final figure in the story is Newton, who published "Mathematical Principles of Natural Philosophy" in 1687. Building upon the work of his predecessors, he formulated a universal law of gravity that embraced heaven and earth in one grand system. Most important, the new system operated in accord with natural laws that were immutable, inviolable, and discoverable through human reason. In his scientific works Newton had stressed experimentation and mathematics; both became the bases for a new methodology for arriving at truth. Subsequently, scientific societies were formed (the Royal Society in London and the French Academy of Sciences) to share findings and methods.

## **THE SCIENTIFIC METHOD**

The harbingers of this new scientific method were Francis Bacon (1561-1626) and Rene Descartes (1596-1650). Stressing empiricism and deriving his "truths" from experimentation, Bacon was the inductive thinker. Descartes was the deductive thinker. Cartesian rationalism derived "truths" from axioms, deductions, and proofs-like the geometer. His most famous truth, "cogito, ergo sum" ("I think, therefore I am"), rested upon the notion of a rigorous intellect far surpassing the deceiving senses.

## **LOCKE'S EPISTEMOLOGY**

John Locke's (1632-1704) epistemology (the knowledge of how we know what we know) is the bridge between the scientific revolution of the seventeenth century and eighteenth-century Enlightenment. Locke pictured the mind of a newborn as a tabula rasa. Sense impressions hit this blank sheet like so many Newtonian particles. Humans, however, because they have the power and capacity to reason, according to Locke, are able to reflect on these sense impressions and form ideas, unaided by Scriptures, traditional beliefs, or authoritative decrees. In short, natural laws could be discovered through the powers of reasoning.